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Pesticide Exposure in the Caribbean: A Case From Nutmeg Processing

Muge Akpınar-Elci

Old Dominion University, makpinar@odu.edu

My Ngoc Thuy Nguyen

Old Dominion University, mtnguyen@odu.edu

Satesh Bidaisee

Omur Cinai Elci

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Pesticide Exposure in the Caribbean: A Case From Nutmeg Processing

Muge Akpinar-Elci, MPH, MD
MyNgoc Thuy Nguyen, MS
Old Dominion University

Satesh Bidaisee, MPH, DVM
Omur Cinai Elci, MD, PhD
St. George's University

Abstract Many developed countries around the world have implemented regulations to phase out or greatly restrict the use of pesticides. Pesticides are still utilized with minimal restrictions, however, in fumigating agricultural commodities in developing countries such as Grenada. This special report presents the case of a nutmeg factory worker in Grenada who worked with various pesticides including methyl bromide, magnesium phosphide (magtoxin), and aluminum phosphide (phostoxin) without the proper awareness and utilization of health and safety measures. The nutmeg factory worker later developed metastatic bladder cancer, which may have been triggered by a combination of individual risk factors along with long-term occupational exposure to these pesticides. In this special report, the occupational health importance of prevention in a work environment with significant exposure to pesticides is highlighted as well as some of the fundamental deficiencies in awareness among workers in developing nations concerning the deleterious effects of frequent exposure to pesticides.

Introduction

Many developed countries around the world have banned or placed strict restrictions on a variety of pesticides that pose significant threats to health and the environment. Some developing countries around the world still apply pesticides such as methyl bromide, magnesium phosphide (magtoxin), and aluminum phosphide (phostoxin) with minimal restrictions on use. In Grenada, methyl bromide was used in the fumigation of nutmeg until around 1995 and then was discontinued due to a national ban. Magnesium phosphide and aluminum phosphide pellets have been used in Grenada recently. These pesticides can lead to severe health issues for exposed workers (Wesseling, McConnell, Partanen, & Hogstedt, 1997).

Methyl bromide is an extremely toxic vapor and the predominant route of entry is through the lungs, although methyl bromide can also enter through the mouth by ingestion and skin by absorption. Since methyl bromide is a fumigant, it can disrupt the exchange of oxygen at a cellular level. Chronic exposure may lead to detrimental health effects including depression, euphoria, personality changes (U.S. Environmental Protection Agency [U.S. EPA], 2013), and various types of cancer. Methyl bromide has been linked to fatal cases of testicular cancer in industrial workers exposed to brominated compounds (Pira et al., 2010) and to cases of prostate cancer in individuals with occupational and community exposure (Alavanja

et al., 2003; Budnik, Kloth, Velasco-Garrido, & Baur, 2012; Cockburn et al., 2011). After methyl bromide was discontinued in the nutmeg plant, magtoxin and phostoxin were utilized as the main pesticides in the treatment of nutmeg starting around 1995. Magtoxin and phostoxin pellets react with moisture from the air to release phosphine gas, which is a highly toxic aromatic amine with health effects such as malaise, tinnitus, pulmonary edema, cyanosis, syncope, and even death with extensive exposure (U.S. EPA, 2015).

This special report examines occupational exposure to these pesticides, highlights the importance of prevention measurements when working with harmful pesticides, and provides valuable insight into the fundamental deficiencies in awareness among workers in developing nations concerning the deleterious effects of frequent exposure to pesticides in the absence of basic workplace precautions.

Case Report

A 46-year-old male presented to his physician in August 2009 with hematuria, which had been persistent since May 2009. Prior to this medical visitation, the male did not obtain any preventative health services. His family medical history was only significant for uterine cancer on his mother's side. Additionally, the male was a nonsmoker with no noteworthy history of heavy drinking or hazardous environmental exposure outside of his current occupation or work history apart from the nutmeg industry. Biopsy revealed that he had metastatic adenocarcinoma of the bladder. The male had been a worker in the nutmeg plant in Grenada for the previous 30 years and eventually stopped working in the plant three months prior to his death

in 2012. The worker signed a consent form to release his medical records for review and agreed to his inclusion in this report.

In 1979, he worked in the stencil room where he was in daily contact with certain dyes and in the pesticides and fumigation room where he was exposed to methyl bromide, magtoxin, and phostoxin. Magtoxin was used as a pesticide in 1999 and then replaced with phostoxin in 2005. In 1999, he was permanently transferred to the pesticides and fumigation room. His primary tasks in this room included spraying the nutmeg with pesticide and fumigating the nutmeg by opening and placing the packets of pesticides in various locations in a 15 ft. x 15 ft. room that was tightly sealed afterwards. After two days, the nutmeg worker manually reopened the room to ventilate the pesticide on the nutmeg.

All tasks were performed by the worker without the utilization of any personal protective equipment (PPE—mask, glove, or proper outfit) and without awareness of the health dangers associated with the pesticide exposure. He never received any pesticide handling training. A visit to the processing plant in 2011 found that the workers in the fumigation room who experienced detrimental health effects also did not wear any PPE and did not receive any safety training or follow a formal procedure regarding the handling of the fumigant and timing of reentry into the fumigation room. The site visit revealed that the solid pesticide tablets used in the fumigation room immediately reacted with atmospheric moisture to produce the toxic gas phosphine. No material safety data sheet (MSDS) for the pesticides used nor product label for the fumigant existed.

Discussion

Occupational exposure to the pesticides mentioned without the utilization of proper

prevention measurement might have caused detrimental health effects among workers in the fumigation room. To examine if the lack of proper prevention and the development of adverse health outcomes in the nutmeg worker were related, confounding variables such as smoking status, non-work-related hazardous environmental exposure, alcohol consumption, chronic bladder irritation and infections, bladder birth defects, cancer-causing genes, prior utilization of chemotherapy and radiation therapy, and fluid consumption were controlled for. The information from the site visit and previous literature (Kesavachandran et al., 2009) show that over 13 years of unprotected exposure to the pesticides methyl bromide, magtoxin, and phostoxin could have been carcinogenic to the nutmeg worker and also this exposure poses a health risk to the other nutmeg workers. Another major finding from the workplace assessment was that a widespread deficiency in awareness existed among the nutmeg workers about their personal safety, which could mean that basic workplace safety precautions have seldom been implemented in developing countries. Low levels of education, low perceived benefits of PPE use (Taha, 2000), and competing social, economic, and political challenges (Ahasan & Partanen, 2001) could be possible explanations for this inadequate awareness. Further research is needed to look into this matter and on the chronic effects of exposure to the mentioned pesticides in order to make a conclusive association between pesticide exposure and bladder cancer development in the nutmeg worker. The occupational work included fumigant replacement, increased ventilation, and worker training and successfully led to workplace alterations, the formulation of a health and safety committee, and an increase in awareness among workers. A genuine need still exists, however, to promote regular health

screenings for workers and the continuous updating of MSDS about hazardous chemicals (Ward, 2010). By implementing collaborative health education and awareness programs and promoting various disease prevention strategies, it is hoped that a substantial and long-lasting improvement in the health of the workers in the nutmeg facility in Grenada as well as other developing countries will be achieved.

Conclusion

An important key point of this research is that occupational health and safety must be utilized by workers when working with pesticides or in a substantial pesticide exposure environment. In addition, awareness about the inherent dangers of a work environment is essential in preventing the development of detrimental health effects in workers. Both developed and developing countries must work together and with their individual governments to provide and maintain a safe work environment for all workers. Most importantly, a significant amount of literature is available on pesticide exposure and utilization patterns in workers but most of the literature is from developed countries. Developed countries have different working conditions, exposure patterns, and chemicals compared to developing countries so it is beneficial to gain a perspective on occupational health from a developing country's perspective. This new perspective will help decision makers from both developed and developing countries to make occupational health and safety decisions that are best suited for the needs of that particular country. 🚗

Corresponding Author: Muge Akpinar-Elci, Director, Center for Global Health, Associate Professor, College of Health Sciences, Old Dominion University, Norfolk, VA 23529. E-mail: makpinar@odu.edu.

References

- Ahasan, M.R., & Partanen, T. (2001). Occupational health and safety in the least developed countries—a simple case of neglect. *Journal of Epidemiology*, 11(2), 74–80.
- Alavanja, M.C.R., Samanic, C., Dosemeci, M., Lubin, J., Tarone, R., Lynch, C.F., Knott, C., Thomas, K., Hoppin, J.A., Barker, J., Coble, J., Sandler, D.P., & Blair, A. (2003). Use of agricultural pesticides

- and prostate cancer risk in the agricultural health study cohort. *American Journal of Epidemiology*, 157(9), 800–814.
- Budnik, L.T., Kloth, S., Velasco-Garrido, M., & Baur, X. (2012). Prostate cancer and toxicity from critical use exemptions of methyl bromide: Environmental protection helps protect against human health risk. *Environmental Health*, 11(5), 1–12.

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References *continued from page 63*

Cockburn, M., Mills, P., Zhang, X., Zadnick, J., Goldberg, D., & Ritz, B. (2011). Prostate cancer and ambient pesticide exposure in agriculturally intensive areas in California. *American Journal of Epidemiology*, 173(11), 1280–1288.

Kesavachandran, C.N., Fareed, M., Pathak, M.K., Bihari, V., Mathur, N., & Srivastava, A.K. (2009). Adverse health effects of pesticides in agrarian populations of developing countries. *Reviews of Environmental Contamination and Toxicology*, 200, 33–52.

Pira, E., Pilate, G., Negron, E., Romano, C., Buffet, P., Lipworth, L., McLaughlin, J.K., & La Vichada, C. (2010). Bladder cancer mortality of workers exposed to aromatic amines: A 58-year follow-up. *Journal of the National Cancer Institute*, 102(14), 1096–1099.

Taha, A. (2000). Knowledge and practice of preventative measures in small industries in Al-Khobar. *Saudi Medical Journal*, 21(8), 740–745.

U.S. Environmental Protection Agency. (2013). *Methyl bromide (bromomethane)*. Retrieved from <http://www.epa.gov/ttn/atw/hlthef/methylbr.html>

U.S. Environmental Protection Agency. (2015). *Expanded aluminum and magnesium phosphide use restrictions*. Retrieved from <http://www.epa.gov/oppsrrd1/reregistration/alphosphide/aluminum-magnsm-phos-fs.html#expanded>

Ward, E. (2010). Cancer. In B.S. Levy & D.H. Wegman (Eds.), *Occupational and environmental health: Recognizing and preventing disease and injury* (pp. 366–397). New York: Oxford University Press.

Wesseling, C., McConnell, R., Partanen, T., & Hogstedt, C. (1997). Agricultural pesticide use in developing countries: Health effects and research needs. *International Journal of Health Services*, 27(2), 273–308.

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